



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,638	08/18/2003	Peng Zhou	COOL-01500	4432

28960 7590 03/12/2007  
HAVERSTOCK & OWENS LLP  
162 NORTH WOLFE ROAD  
SUNNYVALE, CA 94086

EXAMINER
----------

EARLY, MICHAEL JACOBY

ART UNIT	PAPER NUMBER
----------	--------------

3744

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/12/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/643,638

Applicant(s)

ZHOU ET AL.

Examiner

Michael J. Early

Art Unit

3744

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 06 December 2006.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>1/8/07</u> . | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

**Claim Rejections - 35 USC § 103**

The following is a quotation of 35 USC. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 US 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 USC. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 USC. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 USC. 103(c) and potential 35 USC. 102(e), (f) or (g) prior art under 35 USC. 103(a).

Claims 1 and 4 are rejected under 35 USC. 103(a) as being unpatentable over Koo et al. ("Modeling of Two-phase microchannel Heat Sinks for VLSI Chips") in view of Freund (US 6,718,781 B2).

Art Unit: 3744

Regarding claim 1, Koo et al. disclose a method that is capable of being performed by the disclosed apparatus that comprises at least one heat-generating device (IC Chip; Figure 1) using a cooling system (as seen in Figure 1), wherein the method comprises using at least one pump (Electrokinetic pump; Figure 1) to cause a fluid to flow in a sealed cooling system (as seen in Figure 1) including at least one heat exchanger (Microchannel Heat Exchanger; Figure 1); and wherein the apparatus' fluid remains sealed within the cooling system (as seen in Figure 1).

Koo et al. further disclose that both the pressure drop and pump power are dependent upon the mass flowrate of the flowing fluid within the system (see page 425, last paragraph).

Koo et al. do not expressly disclose adjusting the refrigerant's pressure in relation to the fluid's boiling temperature.

Freund et al. teach of a closed loop refrigeration system wherein the system's operating conditions are dynamically controlled through an electronic expansion valve (see Abstract). Freund et al. further disclose that during the circulation of the working refrigerant, the refrigerant passes through a small orifice that causes the refrigerant's pressure to decrease, which in turn, also lowers the refrigerant's boiling point temperature (see col. 5, lines 27-38).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify existing the system of Koo et al. by adjusting the circulated refrigerant's pressure to correspondingly adjust the refrigerant's boiling point temperature, as taught by Freund et al., in order to provide efficient cooling of the system and permit higher fluid temperatures, which in turn would maximize the apparatus' heat exchanging capabilities.

Art Unit: 3744

Regarding claim 4, Koo et al. disclose providing at least one heat rejector (Condenser) for rejecting heat from the system to ambient air (as seen in Figure 1), the at least one heat rejector being situated downstream of the at least one heat exchanger (as seen in Figure 1).

Claims 2, 27 and 28 are rejected under 35 USC. 103(a) as being unpatentable over Koo et al. as modified by Freund et al. as applied to claim 1 above, and further in view of Takahashi et al. (US 6,182,742).

Koo et al. as modified by Freund et al. do not expressly disclose the pressure of the refrigerating fluid is adjusted in the system by adjusting the operating conditions of the pump in response to the change in the temperature of the fluid.

Takahashi et al. teach of adjusting pressure of the refrigerating fluid in a cooling apparatus (1000) by adjusting the operating conditions of the pump (1110A) in response to the change in the temperature of the fluid to be old in the refrigeration art (see col. 7, lines 15-22; col. 8, lines 12-18). Takahashi et al. further disclose that temperature detectors (1300A, 1300B) are positioned on a distribution header (1200), which is in fluid communication with the apparatus' heat exchangers (1120A, 1120B) (as seen in Figure 1).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify existing the system of Koo et al. as modified by Freund et al. by adjusting the operating conditions of the pump in response to the change in the temperature of the fluid, as taught by Takahashi, in order to adjust the pressure of the refrigerating fluid in the system prior to it entering the heat exchangers.

Claims 3, 14-21, 26, 31 and 32 are rejected under 35 USC. 103(a) as being unpatentable over Koo et al. as modified Freund et al. as applied to claim 1 above, and further in view of Wightman (US 2003/0121274).

Koo et al. as modified Freund et al. do not expressly disclose the pressure of the refrigerating fluid is adjusted in the system by adjusting an orifice coupled to the heat exchanger in response to the change in the temperature of the fluid.

Wightman shows adjusting pressure of the refrigerating fluid in the system by adjusting an orifice (18, Figure 1) coupled to the heat exchanger (14, Figure 1) in response to the change in the temperature of the fluid (32) to be old in the refrigeration art.

Regarding claims 3, 31 and 32; it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify existing the system of Koo et al. as modified Freund et al. by adjusting pressure of the refrigerating fluid in the system by adjusting an orifice coupled to the heat exchanger prior to it entering the heat exchanger, but based on the temperature of the fluid after the heat exchanger with the heat generating device, as taught by Wightman, in order to have a precise and rapid response of the orifice to variations in volumetric expansion rate [0005].

Also, Koo et al. as modified Freund et al. do not disclose a particular type of refrigerant used, be it water, trichlorofluoromethane (R-23), pentafluoromethane (R-125), a zeotropic blend comprising R-404a, an azeotropic blend consisting of R-500 and R-502, or ammonia, as claimed by the applicant. Wightman shows that water, trichlorofluoromethane (R-23), pentafluoromethane (R-125), a zeotropic blend comprising R-404a, an azeotropic blend consisting of R-500 and R-502, or ammonia (0046), to be refrigerants common in the refrigeration art.

Regarding claims 14-21 and 26, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify existing the system of Koo et al. as modified Freund et al. by specifying the type of refrigerant used, as taught by Wightman, in order to make the product more user- and environment-friendly.

Art Unit: 3744

Claims 5-7 and 9-11 are rejected under 35 USC. 103(a) as being unpatentable over Koo et al. as modified by Freund et al. as applied to claim 1 above, and further in view of Tilton et al. (US 2004/0089008).

Koo et al. as modified by Freund et al. do not expressly disclose the use of a reservoir to accommodate gas generated during boiling and reduce the change in pressure, said reservoir being downstream from the heat rejector and upstream from the pump.

Tilton et al. teach the use of a reservoir (25, Figure 2) to accommodate gas generated during boiling and reduce the change in pressure, said reservoir being downstream from the heat rejector (30, Figure 2) and upstream from the pump (40, Figure 2) to be old in the refrigeration art. Also, since the reservoir is used to store the vapor, it would be an obvious design choice to have such tank at a sufficient volume to contain the maximum amount of gas generated in the heat exchanger. Finally, the applicant is reminded that the use of a one piece construction instead of the structure disclosed in Tilton et al. would be merely a matter of obvious engineering choice, *In re Larson*, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify existing the system of Koo et al. as modified by Freund et al. by incorporating a reservoir, integral with the heat rejector and the pump, as taught by Tilton et al., to accommodate gas generated during boiling in order to reduce the change in pressure and prevent possible pump cavitation [0053].

Claim 8 is rejected under 35 USC. 103(a) as being unpatentable over Koo et al. as modified by Freund et al. and Tilton et al. as applied to claim 5 above and still further in view of Cowans (US 6,775,996).

Koo et al. as modified by Freund et al. and Tilton et al. do not expressly disclose the reservoir is upstream of the heat rejector.

Cowans teaches the use of a reservoir (92, Figure 2) to accommodate gas generated during boiling, said reservoir being upstream from the heat rejector (44, Figure 2) to be old in the refrigeration art.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify existing the system of Koo et al. as modified by Freund et al. and Tilton et al., by using a reservoir to accommodate gas generated during boiling upstream of the heat rejector, as taught by Cowans, in order to use the gas as a heat exchanging fluid for another purpose (subcooler 52, Figure 2).

Claims 12 and 13 are rejected under 35 USC. 103(a) as being unpatentable over Koo et al. as modified by Freund et al. as applied to claim 1 above, and further in view of Chesser et al. (US 2004/0040695).

Koo et al. as modified by Freund et al. do not expressly disclose the system is hermetically sealed, where the pressure varies less than 1 psi during a five year lifetime.

Chesser et al. teach the use of a hermetically sealed pumped loop cooling system [0042] to be old in the refrigeration art. Also, any hermetically sealed system is completely sealed, which provides no variations in the pressure, including a change in pressure of 1 psi.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify existing the system of Koo et al. as modified by Freund et al. by using a hermetically sealed pumped loop cooling system, as taught by Chesser et al., in order to prevent outside elements from factoring in the cooling variations and the systems performance (sub-atmospheric conditions, [0042]).



Art Unit: 3744

Claims 22-25 are rejected under 35 USC. 103(a) as being unpatentable over Koo et al. as modified by Freund et al. as applied to claim 1 above, and further in view of Gold (US 6,023,934).

Koo et al. as modified by Freund et al. do not expressly disclose a particular type of refrigerant used, be it a hydrocarbon like methane, or a cryogenic like helium.

Gold teaches the use of a hydrocarbon like methane (see col. 4, line 12), or a cryogenic like helium (see col. 1, lines 18-19) as a refrigerant to be used in the refrigeration art.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify existing the system of Koo et al. as modified by Freund et al. by specifying the type of refrigerant used, as taught by Gold, in order to make the product more user- and environment-friendly.

Claims 29 and 30 are rejected under 35 USC. 103(a) as being unpatentable over Koo et al. as modified by Freund et al. as applied to claim 1 above, and further in view of Jiang et al. ("A Closed-Loop Electroosmotic Microchannel Cooling System for VLSI Circuits").

Koo et al. as modified by Freund et al. do not expressly disclose using an electroosmotic pump as pumping means and a catalytic recombiner, coupled to the inlet port of the pump, wherein the hydrogen and oxygen are combined to produce water.

Jiang et al. teach the use of an electroosmotic pump (see page 4, lines 6-8) as pumping means and a catalytic recombiner (as seen in Figure 8) to be used in the refrigeration art.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify existing the system of Koo et al. as modified by Freund et al. by using an electroosmotic pump as pumping means, as taught by Jiang et al., since electroosmotic pumps do not require any movable parts and are very compact (see

Art Unit: 3744

page 4, line 8), and a catalytic recombiner, coupled to the inlet port of the pump in order to recombine the gas during electrolysis (see page 9, lines 1 – 2).

### **Response to Arguments**

Applicant's arguments, see Remarks (pages 7-10), filed 12/6/06, with respect to the rejection(s) of claim(s) 1 under 35 USC § 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Koo et al. ("Modeling of Two-phase microchannel Heat Sinks for VLSI Chips") and Freund et al. (US 6,718,781 B2).

### **Conclusion**

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Early whose telephone number is (571) 272-3681. The examiner can normally be reached on Monday - Friday, 7am - 4:30pm.

Art Unit: 3744

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl Tyler can be reached on (571) 272-4834. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MJE  
3/5/07

Michael J. Early  
Patent Examiner  
Art Unit 3744



  
CHERYL TYLER  
SUPERVISORY PATENT EXAMINER